REMARKS

This communication responds to the Office Action mailed on October 8, 2008.

Claim 11 is amended, no claims are canceled, and no claims are added; as a result, claims 1-22 are now pending in this application.

Information Disclosure Statement

Applicant submitted a Supplemental Information Disclosure Statement and a 1449 Form on October 29, 2008. Applicant respectfully requests that initialed copies of the 1449 Forms be returned to Applicant's Representatives to indicate that the cited references have been considered by the Examiner.

§102 Rejection of the Claims

Claims 11 and 22 were rejected under 35 U.S.C. § 102(b) for anticipation by Vishin et al. (US 5,860,146: hereinafter "Vishin").

Applicant respectfully submits that the Office Action has failed to properly establish a *prima facie* case of anticipation for at least three reasons: 1) Vishin's cluster does not build its RTLB using another cluster's local address space as exported from that cluster; 2) Vishin's RTLB does not translate a virtual memory address to a physical memory address; and 3) Vishin's RTLB does not include a virtual address let alone having, in the virtual address, the remote cluster ID of the remote cluster that built the virtual address.

Vishin's Cluster Does Not Build its RTLB Using Another Cluster's Local Address Space As Exported from That Cluster:

The Office Action makes several assertions with respect to Vishin's source cluster building its RTLB using remote cluster's local address space exported from the remote cluster, and vice versa. *See e.g.* the Office Action, pp. 3- 4. As support of this, the Office Action points to FIGS. 1& 4-9 and the associated text, and Abstract of Vishin. *See id.* In particular, referring to col. 7 line 54 to col. 8, line 48 of Vishin, Office Action seems to argue that a use of some UNIX functions such as shmget() and mmap() to set up a file in shared memory is equivalent to

exporting a local address space from one (e.g., remote) node to another (e.g., source) node to build an RTT in that (i.e., source) node as claimed in claim 11.

Applicant respectfully disagrees. In a UNIX system, the shmget() function returns a shared memory identifier associated with the function's *key* parameter. *See* The Open Group Base Specifications Issue 6 IEEE Std 1003.1, 2004 Edition.[1] *Mmap*() function establishes a mapping between a process' address space and a file, shared memory object, or typed memory object. *See* id.[2] Vishin does not, however, show how these two functions are used **to export a source cluster's local address space to a remote cluster for the remote cluster to build its own RTLB** using the source cluster's local address space.

For example, Vishin states that "the RTLB 160 works in much the same way as the regular TLB 122." See Vishin, col. 4, lines 50-54. Vishin further states that "like a conventional cache memory that stores the data most recently used by a processor, the translation look aside buffer (TLB) 122 stores PTEs [(the page table entries)] most recently used by the processor." See id. at col. 1, lines 64-67. That is, the RTLB in a source node has a mapping only for a remote node's pages that have been accessed by a processor of the source node. It follows that the processor in the source cluster begins address translation with none of its RTLB entries mapped into the remote cluster's pages. Thus, under Vishin's approach, many page faults will occur in the source cluster in response to address translation requests for the remote cluster's pages until most of them are mapped into the source cluster.

In contrast, claim 11 recites "**on the remote node the second RTT [of the remote node] is built using a first local address space on the source node exported from the source node to the remote node**" and "**on the source node the first RTT [of the source node] is built using a second local address space on the remote node exported from the remote node to the source node.**" That is, under Applicant's approach, entries of the source node's RTT and the remote node's RTT are mapped (e.g., built) into each other's local address space before the operating system utilizes the RTTs for remote address translation. This allows reducing, if not preventing, initial page faults in response to address translation requests for the remote node's local address space. Applicant was unable to find such a teaching within the bounds of Vishin.

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[1] http://www.opengroup.org/onlinepubs/009695399/functions/shmget.html
[2] http://www.opengroup.org/onlinepubs/000095399/functions/mmap.html

Vishin's RTLB Does Not Translate a Virtual Memory Address to a Physical Memory Address:

The Office Action also argues that Vishin discloses a source node translating a virtual memory address associated with a remote node to a physical address on the remote node as a function of the source node's RTLB, and vice versa. See the Office Action, pp. 5-6. As support of this, the Office Action points to FIGS. 1 & 4-8 and the associated text, and Abstract of Vishin. _See id._

Applicant respectfully disagrees. In particular, as shown in FIG. 5 of Vishin, the TLB 122 translates an incoming virtual address (VA) to a physical address (PA). Vishin further and repeatedly states that "**a physical address** [translated by the TLB] **is converted by the RTLB** into a remote physical address only if the physical address does not correspond to a location in either the local primary memory 108 or the local secondary memory 110." See e.g. Vishin, col. 4, lines 58-62; and FIG. 5. Therefore, it is simply incorrect for the Office Action to assert that Vishin's RTLB translates a virtual memory address into a physical memory address.

Vishin's RTLB Does Not Include a Virtual Address Let Alone Having, in the Virtual Address, the Remote Cluster ID of the Remote Cluster That Built the Virtual Address:

The Office Action further argues that Vishin discloses both the source and remote nodes' RTLBs including one or more virtual addresses and each virtual address including a node number of a remote node that built the virtual address. See the Office Action, p. 6. As support of this, the Office Action points to FIGS. 4-8 and the associated text of Vishin, especially to FIG. 7 (170: "Node-ID" and 172: "remote physical page address").

Applicant respectfully disagrees. As discussed above, Vishin's RTLB converts a physical address that is already translated by a TLB into a remote physical address. As such, the RTLB does not have a virtual address. See e.g.Vishin, FIGS. 6 & 7. Furthermore, Vishin states that "the remote physical page address (RPPA) entry consists of ... the Node-ID 170 indicating the node of the system 100 at which the addressed data is stored, [and] the remote physical page address 172 indicating the address of the page or memory block at that node where the addressed data is stored." That is, the Node-ID 170 is a part of the remote physical address that results

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from the address translation by the RTLB. Therefore, it is simply incorrect for the Office Action to assert that Vishin's RTLB includes one or more virtual addresses and that each of the virtual address included in the RTLB has a node number of a remote node that built the virtual address as required by claim 11.

For the reasons set forth above, Vishin does not disclose a multi-node system as taught by Applicant and claimed in claim 11. Reconsideration and allowance of claim 11 is respectfully requested.

Claim 22 is allowable as being dependent on claim 11 which is believed to be allowable.

Allowable Subject Matter

Claims 1-10 and 12-21 have been allowed.

CONCLUSION

Applicant respectfully submits that the claims are in condition for allowance, and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicant's representative at (612) 373-6909 to facilitate prosecution of this application.

If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

Respectfully submitted,

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